

## Bewdley – River Flood Defence sewer diversion works for Phase 1 EA scheme

**B**ewdley, a small town located on the banks of the River Severn and neighbouring Wribbenhall lie on land that gently rises either side of the river, joined by a grade 1 listed river bridge designed in 1801 by Thomas Telford. Bewdley is admired for the Georgian buildings which front the river and form part of the town centre conservation area. However, the river which originally brought prosperity to the town, also brought constant risk of flooding to a considerable number of properties in the community.



Bewdley flood (courtesy Severn Trent Water).

The largest flood in living memory occurred in 1947, when water levels were recorded at 5.8m above summer levels. In Autumn 2000, the worst flooding for over 50 years hit the River Severn, and in particular Bewdley which was flooded three times in the space of six weeks. Extensive public and political interest generated by this event led to the Environment Agency (EA) accelerating their proposals for flood defences in Bewdley.

Phase 1 of the EA scheme was to protect Severnside North, which is upstream of Telford's Bridge. The proposal adopted by the EA was to use a demountable flood wall which would only be erected at times of high river flow. The barrier would create a 'dry cell' thereby protecting properties along Severnside North.

Severn Trent Water's involvement in the scheme started in December 2001, with an initial approach by the EA regarding sewer diversion work. Originally, the EA were to carry out all design work, however in early 2002 Severn Trent Water was asked to take on responsibility for the design of any sewer diversions that may be required.

In order to maintain the 'dry cell' when the barrier is in use, consideration had to be given to preventing river water entering existing surface water sewer outfalls in Severnside North and thereby causing flooding.

There were three outfalls identified, the major one being a 800mm

dia surface water sewer from Load Street, discharging into the river by the bridge. The other two outfalls were dealt with by the EA as part of their works.

The 800mm dia surface water sewer from Load Street takes flow from a large part of the Bewdley catchment. The design proposal was to divert this sewer to a pumping station in either Load Street car park or Dog Lane car park and pump flow to an existing surface water sewer in Dog Lane car park which lies outside of the 'dry cell'. It was intended that the diversion sewer would only be used when the flood barrier was deployed.

Load Street car park, located within the conservation area, is extensively used for short stay parking by people using local facilities and any closure would need to be kept to the minimum.

The route between the two car parks was not suitable for open cut techniques and the only viable alternative was to construct the sewer in tunnel. The project also involved open cut works in Load Street and lining using a cured in-place liner of a length of the 800mm dia surface sewer just upstream of its outfall.

### Ground conditions

Ground investigation indicated the geological sequence to be firm alluvial clays over sands and gravels over sandstone. High permeability was also recorded in the sands and gravels.



Separation plant in use at Bewdley (courtesy Barhale Construction).

### Tunnelling technique

Severn Trent Water invited two of its framework contractors to submit proposals for construction of the tunnel. Options presented ranged from a single drive (Load Street to Dog Lane) 1.0m diameter tunnel in the sandstone to a twin drive shallower 600mm dia micro tunnel in the sands and gravels. The twin drive option required the closure of Load Street car park in order to construct the tunnels from a centrally located shaft. *Haswell Consulting Engineers* advised Severn Trent Water on the suitability of the options and following a joint assessment of the risks and costs the twin drive option was selected as the most suitable.

*Barhale Construction Plc* was selected to develop the project in partnership with Severn Trent Water and additional site investigation was then carried out to ensure shafts could be constructed at the required locations.

### Barhale solution

By offering an innovative value engineered solution, *Barhale* were able to demonstrate a number of benefits to all stake holders:

- \* cost – *Barhale*'s twin drive through the sands and gravels demonstrated a saving of £900k over a single drive through sandstone;
- \* environmental impacts – smaller drive and reception shafts resulted in less disruption to residents and businesses in the town,



Bewdley: Small footprint 3m drive shaft (courtesy Barhale Construction).

the quality of spoil was significantly reduced and resulted in fewer vehicle movements, the smaller machines used required less energy, and they could use their innovative closed circuit mud recycling system, saving cost and environmental impact.

The project could not have been undertaken without the use of trenchless technology. Without this approach at an affordable cost the residents would still be at risk from future flooding.

### Stakeholder management

A major consideration of the project was the management of stake holders, including utility companies, highways authority, local authority, businesses and customers. Public meetings and an exhibition were held to inform all parties of the proposals. Letter drops were undertaken throughout the life of the project. Extensive consultations were held with Utilities regarding diversion works ahead of the main construction. Negotiations were also held with the highways authority and local authority regarding traffic management and closure of car parks. The early consultations paid dividends in that diversions were completed generally to programme and any problems with traffic management or car park closures were reached quickly at local level. Customers and businesses were also kept fully informed before, during and after completion of the contract.

### Programme

Major programme milestones were:

- \* May 2002: *Barhale* appointed to develop project in partnership with Severn Trent Water;
- \* May - August 2002: design finalised, utility diversions carried out, ongoing consultations with stakeholders;
- \* September 2002: EA complete flood defence works;
- \* September – December 2002: Severn Trent Water/*Barhale* construct & complete sewer diversion work.

The programme was very short and also carried a risk that if the diversion works were not completed to programme the possibility of flooding was very high. Tunnelling work was completed ahead of programme and Load Street car park released earlier than anticipated.

### Safety

The project was well managed with no incidents, however, a situation did arise, the outcome of which demonstrated the effectiveness of a team approach to resolving problems. This occurred on one of the tunnel drives when a slurry pump failed with the drive almost 90% complete. The pump is located some 20m behind the tunnelling machine and required replacement in order to complete the drive.

Various options were considered but after a joint method statement developed by *Barhale* and Severn Trent Water, a man entry option was pursued and recovery went well as planned. This joint approach to problem solving resulted in a successful recovery, minimal cost and time loss and a sound method that could be used again in a similar situation.

The contract was awarded with a Target Price of £631,938 and the forecast outturn on completion is £616,848.

### Conclusions

The benefits of a partnering approach have been clearly demonstrated on this project which was delivered within programme and budget, with at all times a commitment to quality, safety and customer care. Customers and businesses were kept fully informed and will, of course, benefit from the flood defence works. ■

**Note:** *The editor & publishers thank Severn Trent Water, Barhale Construction and the Environment Agency for producing the above article.*